JPRS: 4840

3 August 1961



# SELECTED TRANSLATIONS

# ON EAST EUROPEAN MATERIALS INDUSTRIES (4)





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JPRS: 4840

CSO: 1857-S/4

# SELECTED TRANSLATIONS

# ON EAST EUROPEAN MATERIALS INDUSTRIES (4)

This is a serial publication containing selected translations on the fuel, electric power, mining, metallurgical, and construction materials industries in Eastern Europe. Additional bibliographic information accompanies each article.

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# INDUSTRIAL USE OF ALUMINUM IN HUNGARY

[Following is the translation of an article by Egon Kasper in Muszaki Elet (Technical Life), Vol XVI, No 11, Budapest 1961, page 7.]

Domestic use of aluminum has significantly risen in recent years. In two years, from 1958 to 1960, the amount of semi-finished aluminum products in the machine industry rose 22%. The same percentage rise took four years in the capitalist countries (1955-59). The capitalist countries used 3.9 million of aluminum in 1959.

We achieved excellent results in several fields, such as transformer and aluminum cable production. The use of aluminum also grew in autobus, tractor and train construction. There is some rise in mass production articles. Between 1958 and 1960 the use of rolled aluminum products increased 240%, in the electrical motor industry, 40%, in the transportation machinery industry, 16%. In the same period the electronics and instrument industry preferred pressed and drawn aluminum products. The use of these aluminum products increased 25% in the electric motor industry.

There are many more fields where aluminum could be used. This is shown by the fact that aluminum consumption per million forints of produced material has actually decreased. The table below gives the necessary data.

Aluminum Use in the Machine Industry
(Tons per million forints of production)

| | 1959 | 1960 | Percent decrease |
|---|---|---|---|
| Semi-finished aluminum products | 0.4567 | 0.4445 | 2.7 |
| Light metal castings | 0.1993 | 0.1873 | 6.0 |

Hence the use of aluminum lagged behind machinery production. Decreases in the specific aluminum use were registered in the truck, tractor, transportation and power producing industries.

## Unexploited opportunities

Our buses use ca. 800 kg of aluminum. This amount could be raised to 1000-1200 kg per bus. That this increase would be in the right direction, is shown by foreign, e.g. US, bus makers where the use of aluminum is increasing. Our bus factories, however, find that aluminum products have a higher price than steel. This prompted them to return to steel after using aluminum in some places, such as the driver's cab and engine blocks in trucks. While these moves decrease the cost, their prudence is debatable.

More aluminum could be used in cable production, too. Progress favors cable covering to lead. Although the Electrical Machine and Cable Factory produces cables covered with aluminum tubes, its capacity is not fully used, due to a lack of aluminum tubing. The solution is made difficult by the fact that transportation of aluminum tubes is not particularly easy or cheap. The Cable and Steel Rope Factory will have a machine (by 1962) which will press the aluminum cover on the cable directly. Here, however, the possibilities of plastics materials should also be explored. In either case, a dollar saving of 66% and a forint saving of 50% can be realized by eliminating lead, according to a study group of the Hungarian Mining and Metallurgical Society.

## Aluminum in the building industry

The same group showed that use of aluminum parts in buildings would result in significant savings in imported materials. Cost of 100 window frames is $528 for wood, $519.15 for steel, and $396.93 for aluminum. At present, because of bottlenecks in pressing in the Metal Works Co., only 100-150 tons of aluminum are used annually for such purposes. The introduction of aluminum is hindered by its more difficult and costlier processing. However, these costs could be decreased by using a more advanced technology.

More aluminum could be used in packaging, too. For instance, aluminum beer casks are widespread abroad. We could follow this example. Although aluminum casks are costlier than wooden ones, their life is longer and they need less repair.

The Metal Research Institute is studying possible uses of aluminum. We expect to use more aluminum for cranes, bridges and light road construction structures in the near future. There are possible uses for aluminum in radiator and various mass production industries.

All these uses are limited by the domestic aluminum production. Careful calculations should be done to see whether a limited amount of aluminum should be imported. In the Five-Year Plan we are conducting a thorough economic study on the most economical uses of aluminum in Hungary. Once the areas are determined, there will be new possibilities in the use of aluminum.

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POLAND

# APPLICATION OF FURNACE FUEL FOR FIRING OPEN-HEARTH FURNACES

/Following is the translation of an article by Magister Engineer Zygmunt Klisiewicz in Wiadomosci Hutnicze (Foundry News), No 3, March 1961, pp 72-78./

In this article are given the characteristics of open-hearth furnaces, a scheme of the installation for bringing fuel-oil to the furnaces, the characteristics of this oil and the technical-economic advantages of firing furnaces with this oil. This article should be read by workers of the steel and heat industries.

For firing open-hearth furnaces in steel plants of the "old foundry," the fuel most often used is bituminous gas, or a mixture of bituminous gas and coke gas. Some foundries use for firing furnaces a "troika" gas (bituminous gas, coke gas, and blast furnace gas) or coke gas carburized by the addition of tar. This method of firing, based mainly on our basic fuel bituminous coal will probably predominate for a long time in the steel plants of the old Polish foundries.

One of the conditions for increasing the productivity of open-hearth furnaces is the conveyance in a unit of time of a correspondingly increased amount of heat; there has been an increase in the conveyance of coke gas of 20-30%. Due, however, to the negative balance of coke gas in the fuel economy of our foundries, the steel plants did not receive the necessary amount of this gas; often they were forced to use exclusively only bituminous gas as a result of numerous damages. In such a situation it is not only difficult to increase the productivity of the open-hearth furnaces but also even to maintain their production on a level assuring normal fulfillment of the plans. Particularly in the steel plants working on the principle of the steady load, receiving coke gas from the outside, it was a very important problem.

Because of these considerations the decision was made to use fuel oil as a supplement to bituminous gas in a number of steel plants, among them the steel plant of the First of May Foundry in Gliwicy.

## Characteristics of Furnaces and Carburetors

This steel plant has three open-hearth furnaces. Two of them have a capacity of 50 tons and one of 30 tons (Table 1); all work on the steady load principle with a share of pig iron of about 450 kg/ton of steel. The basic fuel for these furnaces was bituminous gas with a supplement of 20% of coke gas.

From Table 1 it is seen that furnaces II and III have a somewhat greater width relative to the length of the ladle because of the short distance between the poles of the crane roadways; the ratio of the volume of the chambers to the surface of the ladle is the prescribed $4-5m^3/m^2$.

The three carburetors are so situated that each open-hearth furnace has only one carburetor with a inner diameter of 2.8 meters and a rotary grate without a reservoir collector. This brought about a considerable overloading of the carburetors of the 50 ton furnaces, where the turnover of coal fluctuates within the limits of 200-220 $kg/meter^2/hour$; this made it practically impossible to keep the furnaces going in cases where there was no gas delivery from the gas nets. Due to these considerations the replacement of gas supplements by a supplement of fuel oil was technically fully justified. As the analysis of the last six-month period shows, it was also economically expedient.

## The Quality of Oil

Fuel oil constituting the residue of petroleum distillation, and called popularly "mazut", is produced in three varieties. In Table 2 are given the required properties of this oil according to the standard PN-58/C-96024.

With respect to sulfur content, only oils of grades 1 and 2 can be applied to firing open-hearth furnaces. It is necessary, however, to add that the price of fuel oil of all three grades is 900 zlotys/ton.

In practice, the fuel oil received from domestic and foreign sources has the properties shown in Table 3.

As seen from Table 3 the sulfur content in the oil from the Trzebin Refinery fluctuates within the limits of 1.35-1.60% and the coagulation temperature fluctuates between 19° and 29°C. This corresponds to the oil of grade 2, according to the standard. Oil imported by the Petroleum Industry Administration taken directly from the ship in Gdansk shows a higher sulfur content (2.1%) and a relatively lower flash temperature. In practice, oil with a 1.5% sulfur content, put in the furnace in amount of 35 kg/ton steel, will not increase the sulfur content, put in the furnace in amount of 35 kg/ton steel, will not increase the sulfur content in the first sample after melting; however, with a sulfur content of only 2%, the sulfur content in the first sample will increase to about 0.08% to 0.10%.

## Installation for Fuel Oil

The oil installation consists basically of a reservoir, channels conducting the oil to the furnaces, and burners. The general position of the fuel oil installation is shown schematically in Graph 1. Because of a lack of space and also to facilitate unloading from the side track, an oil reservoir with a capacity of 170 $meters^3$ is placed at a distance of about 200 meters from the furnaces on a level six meters lower than the unloading level (Graph 2). Such a placing has considerably facilitated the unloading of warm oil flows from the cistern

to reservoirs holding 180 tons of oil; with an oil use of 35 kg/ton this constitutes a 14 day reserve and has generally assured normal utilization of the furnaces. The reservoir and the channels bringing the oil to the furnaces are warmed by the departing steam of the plant. The oil in the reservoir is warmed to a temperature of 60 C.

From the reservoir the oil is conveyed by means of a cogwheel pump with a capacity of 120 liter/min (harnessed directly to a motor whose number of revolutions is 750/minute and whose power is 3.5 kw) to the channels. These channels have a diameter of 48 millimeters, are heated by means of steam, and are especially insulated (Graph 3).

The oil pressure near the reservoir is 10 atm; near the furnaces the pressure is 5-7 atm. From the main channel the oil is brought to upper oil burners by means of channels with diameters of 12 milimeters. Compressed air is brought to the burners by means of pipes with 18 millimeter diameters. The construction of the oil burner is shown on Graph 4. It consists of two parts namely, the burner itself and the nozzles bringing compressed air to the upper part of the furnace, injecting cold outside air, cold air from outside. These nozzles were already installed before the adaptation of the furnace for the use of fuel oil. The pressure of compressed air is 4 atm, usage is about 300 Nmeter/hour. Because of the lowering of the temperature of air as it is compressed, an implement has been installed to heat the compressed air to a temperature of about 150°C so that after being compressed the temperature of air will be higher than that of the heated oil, which being near the burners, reaches a temperature of 80° C.

The mixing of oil and compressed air takes place automatically and simultaneously with the help of a Forter lock. The quantity of the inflowing oil is regulated by the first smelter with the help of a lock located on the oil channel.

## Influence of the Oil Supplement on the Work of the Furnaces

The usage of fuel oil instead of coke gas has had increased the productivity of the furnaces and has also diminished the use of fuel. For purposes of analysis, comparisons were made od the work of the furnaces by analysing five meltings from each of the three furnaces, both from before the introduction of fuel oil and after its introduction.

In Table 4 are the data bearing on meltings produced using a mixture of bituminous gas and coke gas; in Table 5 are the data on meltings produced using bituminous gas with a supplement of fuel oil. In order to achieve as close a similarity of operation as possible, the meltings for analysis were taken after a moderate repair of the furnaces; they had number values between 20 and 50, identical furnace conditions (silicic covering), and produced the same kinds of steel.

The increase in productivity of the furnaces is shown in Table 6.

As is seen, the productivity of the furnaces increased for the meltings under discussion by 17-38%.

## Results of Analysis Over a Longer Period

In order to corroborate the results obtained from the above-mentioned meltings, a further analysis was conducted over a period of one year before introducing oil as a supplement and over a period of eight months after introducing oil as a supplement for firing furnaces. In Table 7 are given the results of the analysis of the period before the introduction of the oil supplement and in Table 8 are given the results of the analysis carried out in the period after introducing oil as a supplement. These tables show that the hourly productivity of the furnaces after introducing the oil supplements increased relative to the period before the introduction from 5.38 to 5.53 ton/hour, or by 4%. The use of fuel per one kg of melted steel before and after introducing the fuel oil supplement is shown in Table 9.

Altogether the use of fuel diminished by

2035.1-1942.6=92.5 kilocalories/ton

This is not a great reduction; however, it is almost certain that after removal of the narrow necks of the steel plant there will be a considerable reduction in the use of fuel.

## Economic Gains

In order to demonstrate the economic gains of using fuel oil as a firing supplement, a comparison was carried out in the use of coke gas and fuel oil; this comparison was done in $Nm^3$/ton, in kg/ton, and in zlotys/ton of steel. Table 10 shows the comparisons of use and cost based on the actual price of coal, gas, and fuel oil.

As seen from Table 10, the application of fuel oil brings great economic gains, especially after the increase of the price of one $Nm^3$ of gas from 0.35 to 0.75 zlotys.

If we take into consideration the average use of gas for a four month period before the introduction of fuel oil, we obtain the cost of fuel (at an average use of 98.5 $Nm^3$/ton) in the sum of 34.5 zlotys/ton, and calculating by the new price, 75 zlotys/ton. The average use of fuel oil however, amounts to 29.27 kg/ton or 26.93 zlotys/ton. The clear gain then amounts to 75.0-26.93=48.07.

Taking the average yearly production of steel of the First of May Foundry to be 125,000 tons, we obtain a saving of 6,000,000 zlotys.

This increase in productivity gives a four% increase in production, or 5000 additional tons of steel. When the average cost of production of liquid steel using the price prevailing before 1 July 1960, is 451.38 zlotys, and the overhead cost is 39% or 175 zlotys per ton, we obtain here an additional savings of 5,000x176=880,000 zlotys.

Altogether, the savings amount to 6,000,000+880,000=6,880,000 zlotys.

The application of fuel oil then yields great economic gains. These gains should increase with the further perfecting of technological processes.

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POLAND'S ENERGY RESOURCES

[Following is the translation of article by Odon L. Kovacs in Villamossag (Electricity), Vol IX, No 5, Budapest 1961, pages 129-131.]

Poland is very rich in coal and soft coal deposits. Her coal reserves equal 1,170 billion kw-hr of energy. At the present time Polish electrical power generation is based primarily on coal. 98.6% of all the electrical energy generated in conventional power plants is coal-based. Hydroelectric power generation is insignificant compared to coal; only 4% of the total energy production comes from hydroelectric power.

In the future soft coal will be used more and more in the power plants. The main soft coal deposits are in the western and central parts of the country. Table 1 shows the projected sources of electrical energy in the coming years. It can be seen that within the next 15 years electrical energy generation will be based on soft coal.

3787 new or reconstructed power plants have been put in operation since the war. The country's power capacity in 1958 amounted to 5,570 MW (the power capacity in 1938 was 1692 MW). In these 20 years electrical energy production rose from 3.97 billion kw-hr to 24 billion kw-hr. By the end of 1965 power capacity should be 10,000 MW and electrical energy produced should be 45 billion kw-hr. By 1975 power capacity should be 20,000 MW and the production should reach 92 billion kw-hr.

The country has 250 power plants, 25 of which are large plants which form the basis of the electrical system. These 25 plants generate 90% of all electrical energy. At the end of 1958 the 220 V network had a length of 800 km, the 110 V network was 8,000 km long.

The power economy was reorganized early in 1959. Regulating agencies were shorn of some of their bureaucratic power; factory management was simplified and productivity was considerably raised. The energy economy is now under the Ministry of the Coal Industry and Energy Economy. The country is presently divided into six power districts. Every district has several power combines which run power plants, networks and maintenance shops. More than half of the output is in the Southern District which includes the Gorny Slansk industrial area and Cracow County. Electrical energy data of this district during the years 1950-1956 is given in Table 2.

The table shows that the Dolny Slansk and the west are going to get a great deal more energy by 1965. This emphasis is in accordance with the shift from hard to soft coal.

To show the pace of power plant building we learned that while in 1950 70.6% of the electrical energy was generated in old power plants; by 1958 this figure dropped to 9.9%. In the same period, improved power plants generated 42.5% of the energy (vs. 29.4% in 1950). New power plants produced 47.5% of the electric power in 1958.

In the power plants built since 1950, first medium, then high pressure and 35, 50, and 55 MW turbine units were used. Since 1958, a pressure of over 100 atmospheres and interim super-heating are being used. One of the plants installed recently uses steam at 110 atmospheres at 535° C. The Polish-made boiler has a capacity of 230 t/hr. Capacity of the turbine units has been raised to 70 to 100 MW. Recently the Polish boiler industry has started making boilers working at 127 atm and 530° C and having a capacity of 375 t/hr. They are connected with 127 MW turbine units. The Turow power plant operates with 200 MW Soviet-made turbine units. The boilers there have a capacity of 650 t/hr and work at 162 atm and 540° C, using interim super-heating.

The total efficiency of the power plants was raised from 14.5% in 1950 to 21% in 1958. 40.6% of the total boiler capacity was fully, and 38.7% was partially automatized in 1958. 95% of the transmission line was equipped with quick switch-on. 53% of the reserves can be automatically switched on.

Modernization resulted in a gradual decrease in specific coal consumption. The average coal consumption of the power plants in 1950 amounted to 0.8 kg/kw-hr. This figure was reduced to 0.52 by 1958. The new modern power plants have a specific coal consumption of 0.42-0.46 kg/kw-hr.

Consumers and their ratios are given in Table 3. The table also gives projected data.

Before World War II, the per capita consumption of electric power was very low. Consumption grew after 1945. By 1950 it reached 350 kw-hr per year. In 1958 consumption grew to 842 kw-hr annually per capita which is eight times larger than the 1938 figure. Poland occupied eighth place among the European countries that year. In the same 20 years the average per capita consumption of the world doubled and that of Europe tripled. Projected per capita consumption for 1965 is 1240; for 1970 it is 1580, and for 1975 it will be 2070 kw-hr annually.

Of the soft coal power plants, the 465 MW Korin, the 480 MW Adamow, and the 500 MW Patnow should be mentioned. The Turow plant will have a capacity of 1200 MW after the first expansion. By shifting to soft coal, costs will go down and the coal reserves will be protected.

The power plants are being combined with central heating to an ever larger extent. In Warsaw, the old 65 MW and the new, Soviet-designed 250 MW power plants are central heating plants at the same time. A 200 MW capacity central heating plant will complete the central heating system of the city. Lodz, Wroclaw and other cities will also get central heating plants.

As we mentioned earlier, the hydroelectric power of Poland is not significant, its capacity is estimated to be ca. 2200 MW. Of this, the Vistula can generate 1200 MW, the other rivers (Dunavets, San, Brda) generate 200 MW. Dams could make up the rest. Presently the total hydroelectric output is 200 MW. Since it costs two to three times as much to build a hydroelectric plant as it does a coal burning plant, they will be built only where the rivers need control.

Table 1

Polish Electric Power Production between 1955 and 1975

| Basis | Power Production in % | | | | | Capacity % | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | 1955. | 1960. | 1965. | 1970. | 1975. | 1955. | 1960. | 1965. | 1970. | 1975. |
| Coal | 95,3 | 93,3 | 68,0 | 49,7 | 43,1 | 93,8 | 91,9 | 76,9 | 61,7 | 54,7 |
| Soft Coal | 0,7 | 4,6 | 28,4 | 42,0 | 44,8 | 0,5 | 4,3 | 17,7 | 28,2 | 31,4 |
| Hydroelectric | 4,0 | 2,1 | 3,6 | 4,8 | 6,4 | 5,7 | 3,8 | 5,4 | 7,9 | 10,2 |
| Nuclear Energy | — | — | — | 3,5 | 5,7 | — | — | — | 2,2 | 3,7 |

Table 2

Electric Power Production in the Six Districts

| District | Power Production, % | | | | Capacity, % | | | |
|---|---|---|---|---|---|---|---|---|
| | 1950. | 1955. | 1960. | 1965. | 1950. | 1955. | 1960. | 1965. |
| | 12,4 | 11,6 | 13,4 | 11,5 | 13,4 | 12,3 | 14,5 | 13,8 |
| East | 6,2 | 5,6 | 7,1 | 4,6 | 7,8 | 6,5 | 7,8 | 5,4 |
| South | 58,5 | 61,8 | 59,8 | 45,0 | 47,5 | 55,2 | 51,1 | 41,0 |
| Dolny Slansk | 10,7 | 7,9 | 7,2 | 22,3 | 14,8 | 10,8 | 8,0 | 17,7 |
| West | 5,5 | 7,3 | 7,9 | 13,2 | 7,5 | 8,2 | 11,6 | 16,3 |
| North | 6,7 | 5,8 | 4,6 | 3,4 | 9,0 | 6,6 | 6,7 | 5,8 |

Table 3

Consumers of Electricity between 1955 and 1975

| Consumer Group | Power Production, in % | | | | | |
|---|---|---|---|---|---|---|
| | 1950. | 1955. | 1960. | 1965. | 1970. | 1975. |
| Industry | 82,2 | 81,2 | 77,8 | 73,3 | 70,8 | 65,5 |
| Transport | 0,3 | 0,8 | 2,7 | 3,5 | 4,0 | 4,9 |
| Cities | 13,5 | 13,6 | 14,3 | 17,1 | 18,3 | 21,1 |
| Rural Areas | 4,0 | 4,4 | 5,2 | 6,1 | 6,9 | 8,5 |

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